X and Y = R.V.'s
a and b = fixed numbers

Rules for combining and manipulating Means

*this is the 2nd half of 4.4 in book

μ_x = mean of X

μ_{2x} = mean of 2X

Rule for multiplication and addition of one variable:

$$\mu_{a+bX} = a + b \cdot \mu_X$$

Rule for Combining X and Y together:

$$\mu_{X+Y} = \mu_X + \mu_Y$$

Example:

1) Random variable X has mean of 6.2. Find the mean if we divide by 12 and add 3.

$\mu_X = 6.2$ $\quad \mu_{\frac{1}{12}X+3} = \frac{1}{12}(\mu_X)+3 \approx \frac{1}{12}(6.2)+3 \approx$ (3.52)

2) Random variable Y has mean of 3.4. Find the mean of X + Y.

$\mu_Y = 3.4$ $\quad \mu_{X+Y} = \mu_X + \mu_Y = 6.2+3.4 =$ (9.6)

3) Find μ_{2X+3Y}

$\mu_{2X+3Y} = \mu_{2X} + \mu_{3Y} = 2 \cdot \mu_X + 3 \cdot \mu_Y = 2(6.2)+3(3.4) =$ (22.6)

Rules for combining and manipulating Std. Deviations

X and Y = R.V.'s
a and b = fixed numbers

σ_X = Std. dev. of X

σ_{2X} = Std. dev. of 2X

σ_X^2 = variance of X

Notes:

- Variance = (Standard deviation)$^2 = \sigma^2$
- ALWAYS... WORK IN VARIANCES!!

* find the σ^2 of what you want 1st, then tak $\sqrt{\ }$ to get to σ.

Rule for multiplication and addition of one variable:

* Adding or subtracting a constant to a variable...

$$\sigma^2_{a \pm bX} = b^2 \cdot \sigma_X^2$$

(*note: "a" has no effect- it's ignored!
adding or subtracting a constant (a) doesn't change σ)

* Rule for Combining X and Y together:

$$\sigma^2_{X+Y} = \sigma^2_{X-Y} = \sigma_X^2 + \sigma_Y^2$$

notice: + and − are same!

Example:

1) Random Variable X has $\sigma = 3.1$.
   Random Variable Y has $\sigma = 1.4$.

   Find:

$\sigma_{x+y} \Rightarrow \sigma_{x+y}^2 = \sigma_x^2 + \sigma_y^2 = (3.1)^2 + (1.4)^2 = 11.57 \Rightarrow \sqrt{11.57} = 3.401$

(σ_{x+y}^2 = σ_{x+y})

$\sigma_{x-y} =$ σ_{x+y} = same as above! 3.401

$\sigma_{2x+3} \Rightarrow \sigma_{2x+3}^2 = \sigma_{2x}^2 = 2^2\sigma_x^2 = 2^2(3.1)^2 = 38.44 \Rightarrow \sqrt{38.44} = 6.2$

(σ_{2x+3}^2, σ_{2x+3})

$\sigma_{3x+y-4} \Rightarrow \sigma_{3x+y-4}^2 = \sigma_{3x+y}^2 = \sigma_{3x}^2 + \sigma_y^2 = 3^2\sigma_x^2 + \sigma_y^2$

$= 3^2(3.1)^2 + (1.4)^2$

$= 88.45$ ← σ_{3x+y-4}^2

$\Rightarrow \sqrt{88.45}$

$= 9.405$ ← σ_{3x+y-4}